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ABSTRACT

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Various manners of presenting 2 vocabularies were compared in terms of rate of learning and amount of immediate and delayed retention. Four concurrent and two consecutive conditions were used, each comprising 2 sets of symbols (nonsense syllables distinguished by a color cue) associated with a common set of referents (nonsense forms). Twenty Ss were used in each of the 6 learning conditions. The most effective condition was a concurrent procedure (Glosses-RBBR) which presented contrasting items in sequences of glosses in such a way that Ss were alerted to the cue which differentiated the vocabularies. Ss in this group were intermediate in rate of learning, but superior in immediate and delayed retention. The results also suggest that interference during learning is not necessarily detrimental if the learning conditions permit and encourage one to overcome interference while learning.

CONCURRENT AND CONSECUTIVE MODES OF LEARNING TWO VOCABULARIES[1]

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The findings of contrastive studies in linguistics provide the language teacher with a means of locating the essential differences and similarities in the structures of any two languages. It is assumed that positive transfer will aid the student in learning the features in the second language similar to those in his native language, while dissimilar features will be more difficult to learn. Most language teachers realize the usefulness of such information, but they differ in the way they make use of it. Some choose to provide the student with additional practice on those features likely to be difficult, in which case they usually do not emphasize the contrasts between the two languages for fear that this might confuse him and therefore retard the learning process. Others choose to direct the student's attention to contrasts in the belief that, once understanding the nature of the difference, he can apply this knowledge to other instances of the contrast. The basic difference between these two approaches can be stated in the following way. Given two languages and one area of training, should contrasting features be emphasized and adjustment to interference incorporated in the learning process, or should conscious awareness of existing contrasts be minimized?

Consider the situation in the early stages of language instruction where the choice of the vocabulary items might be based on some contrastive feature; the teacher then has to decide on the training procedure. The problem encountered

is clearly illustrated in the case of children in bilingual communities where parents and educators have to consider carefully the advantages and disadvantages of having their children learn two languages. Once a decision is made to develop bilingual skill, very little information is available to help decide whether the two languages should be taught concurrently or consecutively. If it is to be concurrently, the existing contrastive features would have to be brought to the student's attention and handled in some way. If it is to be consecutively (e.g., by delaying the introduction of the second language until the student has learned the first) the contrasting features would be kept apart. These are extreme positions and actual practice probably takes many forms. Research on this problem could clarify the relative merits of each approach.

The present study is an experimental analogue of the acquisition of two contrasting vocabularies in which different concurrent and consecutive orders of training procedures are evaluated. The aim is to compare the difficulty encountered in learning, and the quality of retention, in each of these different training procedures. Concurrent training procedures require Ss to learn two vocabularies in a condition where contrasting items appear in close temporal contiguity, thereby introducing the possibility of interference during learning. Consecutive training procedures present the two vocabularies in temporally separate sequences so that training on one vocabulary is completed before the second vocabulary is introduced. In this condition, the learner is presumably less likely to be faced with interference during the training period.

Method

Two artificial vocabularies, composed of unfamiliar symbols and referents, were used, making it difficult for Ss to bring prior associations to bear on the learning task. The artificial vocabularies had identical referents, nonsense forms, and all the symbols were CVC nonsense syllables (Figure 1). Contrasting items are operationally defined as two syllables, each representing a distinctive vocabulary, both associated with one common form. The rows in Figure 1 illustrate the four contrasting items used in this study. Thus the learning material for all Ss was composed of eight different items (form-syllable combinations), four per vocabulary. Six different learning conditions were investigated, four concurrent and two consecutive groups.

A memory drum, rotating at 3 sec. intervals, was used for presentation. The forms were drawn on the left side and the syllables were typed, in block letters, on the right side of the drum tape. A red or blue frame cued the S on the vocabulary he was to respond with. During the anticipation interval S was presented with a form and an empty color frame. Confirmation was immediate in that S was then exposed to the same form and the correct syllable typed within the color frame.

The eight items were divided into two lists of equal length. The content and sequence of items in the lists varied for each of the learning conditions. The four items in a list appeared three times within a trial. Thus, there were 12 responses for each trial (Figure 2). The criterion for learning was defined as one errorless trial, which was always followed by two additional trials. All Ss had to reach criterion on List I before they were presented

Referents	Symbols		
Nonsense forms	Blue vocabulary syllables	Red vocabulary syllables	Concurrent orders
	YOP	QAP	List I
	SIJ	CEF	
	WUB	LAJ	List II
	GOQ	ZUK	
Consecutive orders	List I	List II	

Figure 1. The training materials. The form in each row was associated with a syllable from each vocabulary. Each row represents a contrasting item; the two syllables in each contrasting item are referred to as pairs of glosses in the text. The margins indicate the contents of the lists for the concurrent- and consecutive-order training procedures.

	Groups	Lists	Trials										
Concurrent Orders	Random	I	+	+	=	=	=	[+	=]	+	+	[=	+]	=
		II	+	+	=	=	=	[+	=]	+	+	[=	+]	=
	Alternate	I	+	+	+	+	+	[+	=]	=	=	=	=	=
		II	+	+	+	+	+	[+	=]	=	=	=	=	=
	Glosses-RBBR	I	[=	+]	[+	=]	[=	+]	[+	=]	[=	+]	[+	=]
		II	[=	+]	[+	=]	[=	+]	[+	=]	[=	+]	[+	=]
	Glosses-BRBR	I	[+	=]	[+	=]	[+	=]	[+	=]	[+	=]	[+	=]
		II	[+	=]	[+	=]	[+	=]	[+	=]	[+	=]	[+	=]
Consecutive Orders	Successive	I	+	+	+	+	+	+	+	+	+	+	+	+
		II	=	=	=	=	=	=	=	=	=	=	=	=
	Indirect	I	+	+	+	+	+	+	+	+	+	+	+	+
		II	*	*	*	*	*	*	*	*	*	*	*	*

\+ Blue vocabulary items;
= Red vocabulary items;
* Red vocabulary syllables associated with glosses in the blue vocabulary.

Note: Items in brackets refer to two glosses appearing in sequence.

Figure 2.

Sequences of Items in a Trial for the Six

Learning Conditions

with List II. The trials were run in a continuous loop with no inter-trial interval.

Learning Conditions

Concurrent Orders

The four concurrent-order learning conditions are experimental analogues of situations where two vocabularies are learned at the same time. The lists for these groups contained contrasting items. The four form-syllable combinations illustrated in the first two rows of Figure 1 comprised the items of List I; and List II contained the remaining four items. The learning task for the concurrent-order groups was to associate each of two syllables (the glosses) with one form. The concurrent-order groups differed in (a) the degree to which shifts from one vocabulary to the other were predictable, (b) the temporal separation between each shift, and (c) the number of times pairs of glosses from the two vocabularies appeared sequentially (Figure 2). The following is a description of each group.

Random. In this case, a given item was not followed by itself and the number of times pairs of glosses from the two vocabularies appeared sequentially was infrequent and controlled. The Ss in this group could not predict whether the subsequent item would be from the red or the blue vocabulary.

Alternate. Here the two items from the blue vocabulary were presented three times during the first half of the trial and were followed by three presentations of the two red vocabulary items. Within each trial the Ss alternated between six responses for the blue vocabulary items and six for the red vocabulary items. A given item was sometimes followed by itself, but this

occurred in a random sequence to eliminate serial learning. Because of the systematic alternation between vocabularies, the Ss in this group could predict that they were to work with a set of items from the same vocabulary for a period of time. This training procedure provided the largest temporal separation between glosses from the two vocabularies among the concurrent order groups.

Glosses-RBBR. The vocabulary items for this group were presented in a sequence of glosses. That is, each item was followed by its counterpart in the other vocabulary, but the number of times the red vocabulary item preceded its gloss in the blue vocabulary was counterbalanced. This procedure is analogous to having one referent associated first with the word HOUSE, framed in red and then the word LA MAISON, framed in blue, followed by a second referent associated first, with LA MERE, framed in blue, followed by MOTHER, framed in red, etc. Thus, the pattern of vocabulary shifting followed a red-blue-blue-red (RBBR) order. Since the items were presented individually, Ss could not easily predict the vocabulary of the subsequent item.

Glosses-BRBR. This condition was similar to the preceding one except that the pattern of vocabulary shift was a simple blue-red-blue-red (BRBR) alternation, enabling Ss to predict the vocabulary of the subsequent item during the learning period.

Consecutive Orders

The two consecutive-order training procedures are experimental analogues of second language learning where the new language is introduced only after the first has been acquired. The Ss in these groups learned the complete blue

vocabulary in List I first, and then the complete red vocabulary in List II (Figures 1 and 2). The learning task for these groups was to develop separate associations between each form and its corresponding syllable.

Successive. In this case, the four blue vocabulary items were presented in three random arrangements, constituting one trial on List I. A trial on List II was composed of three random arrangements of the red vocabulary items.

Indirect. For all conditions described thus far, Ss were presented with form-syllable combinations throughout the learning period. The Indirect procedure was unique in that the training procedure on List I was identical to that of the Successive group, whereas on List II, Ss learned to associate the red vocabulary syllables with their blue vocabulary glosses. Thus, the response terms of List I were used as stimulus terms on List II. This condition approximates the indirect method of language teaching which relies heavily on translation. The sequence of response terms on List II was identical to that of the Successive group.

Retention Tests

Following the learning procedure, Ss were given three recall tests. The memory drum was used to present the test items, and Ss were allowed three seconds to respond. The drum was stopped only at the end of each test to instruct Ss about the subsequent test. The tests were: (1) Separated-Order. Ss were presented with a form and an empty colored frame, and were asked to recall the appropriate symbol. They were tested on the four blue vocabulary items first, and then on the four red vocabulary items. (2) Vocabulary Identification. Ss were presented with a form and a syllable without the color

frame and were asked to identify the appropriate vocabulary for this combination by indicating the correct color. There were 13 form-syllable combinations, eight of which were associations they had learned, along with five new combinations. The Ss were instructed to say "neither" if they thought that a given form-syllable combination did not belong to either vocabulary.

(3) Mixed-Order. This test was similar to the Separated-Order test, except that the vocabulary items appeared in random order.

The order of testing was counterbalanced within each group, half of the Ss were tested on Separated-Order, Vocabulary Identification, and Mixed-Order procedures, in that order, while the other half followed the reverse sequence.

Subjects

The Ss were 120 tenth grade students, well above average academically, from an English high school in Montreal. They were assigned to one of six groups according to their scores on a modified form of the Digit Symbol test (Wechsler, 1946), thereby equating the groups on a measure of rote learning and recall. In each of the six groups, there were 20 Ss, 10 males and 10 females.

Procedure

Each S was tested individually for a period of approximately one hour. The Digit Symbol test was administered first. While E scored the test, S read a passage describing the rationale of the experiment. Then S read a description of the distinctive aspects of the group to which he was assigned. The Ss were informed that they were to learn two "artificial languages," a blue one

and a red one, and that they would be tested on their retention of both vocabularies later in the hour. They were also informed that the procedure would continue until the two vocabularies were mastered. As an introduction to each list, S read aloud the syllables as the tape ran for a complete trial. On all subsequent trials he was instructed to anticipate the correct syllables; all responses given were recorded.

Following the learning period, the Ss were given the three recall tests. They were not informed that they would be tested again after an interval of two to three weeks. The same three tests (Separated-Order, Vocabulary Identification, and Mixed-Order) were used. In this instance, each test was printed on a separate sheet and collated into a three-page questionnaire. The questionnaires were in two forms, half had the Separated-Order test on the first page, Vocabulary Identification on the second, and Mixed-Order on the third, and the other half had the reverse order. The tests were group administered in classrooms. The Ss were given three minutes to complete the Separated-Order and Mixed-Order tests and two minutes for the Vocabulary Identification test. Thus, Ss had more freedom during the delayed tests since they could start on any item within a given test and could review their responses.

Results and Discussion[2]

Performance during the Learning Trials

Each S's performance during the learning trials was classified according to the following categories: (1) correct anticipations; (2) within-list reversal errors (e.g., when S gave the gloss of an item in the other vocabulary. This category applied to Ss in the concurrent-order groups only.); (3) intra-list

substitutions (responses appropriate for other stimuli within the lists); (4) responses imported from outside the learning material; and (5) no response. The ratio between each response category and the total number of possible anticipations per item was computed for each S. Table 1 presents the average ratio of each response category and the mean number of trials to reach criterion for the six groups. The number of trials to criterion is an index of the time taken to learn the two vocabularies, and the ratios describe the response patterns within each group. The groups differed significantly in the number of trials required to reach criterion on List I F (5, 114) = 13.32, $p < .01$, and on List II F (5, 114) = 4.08, $p < .01$. In general, the concurrent order groups, with the exception of Glosses-BRBR, required more time to reach criterion than the consecutive order groups.

It is noteworthy that among the concurrent order groups, the Random and Glosses-RBBR, in which S could not predict the vocabulary of the subsequent item, had more reversal errors on List I than the Alternate and Glosses-BRBR groups. On List II, however, the incidence of reversals is reduced in all concurrent-order groups. There were a few instances in which Ss gave a List I response during the List II learning trials, but this was observed in the consecutive order groups only.

These findings indicate that although all Ss learned identical symbol-referent pairs, the different arrangements of the items in List I and List II resulted in different degrees of list difficulty. Consequently, the groups reached the criterion of learning at different rates. This is likely due to the fact that the concurrent order groups had to learn to associate two different

Table 1

Average Ratios of the Different Response Categories

and the Mean Number of Trials to Criterion (N=20)

Groups	Concurrent Orders								Consecutive Orders			
	Random		Alternate		Glosses-RBBR		Glosses-BRBR		Successive		Indirect	
Lists	I	II	I	II	I	II	I	II	I	II	I	II
correct anticipations	2.47	3.08	3.23	3.24	2.88	3.37	3.11	3.36	3.18	3.26	3.56	3.32
Errors:												
reversals	.45	.26	.23	.08	.42	.11	.16	.07	*	*	*	*
intra-list	.67	.26	.29	.29	.36	.17	.36	.14	.42	.39	.22	.20
imports	.08	.07	.03	.03	.13	.12	.17	.14	.07	.06	.04	.07
no response	.34	.33	.23	.36	.22	.24	.20	.29	.33	.30	.18	.41
Trials to Criterion	10.75	5.25	8.10	7.60	9.55	5.15	6.05	3.60	4.20	3.55	3.10	3.10

* Not applicable to consecutive-order groups.

responses to one stimulus on each of their lists while the consecutive order groups were presented with different stimulus-response pairs within each list.

Underwood's (1964) warning about a potential confounding of retention measures is recognized. He states that if the variables in the learning condition influence the rate of learning, differences in "level of learning" must be equated before the groups can be compared on retention measures. Unfortunately, his proposed technique of multiple-entry projections to predict performance after the learning trials cannot be applied to the data of the present study: the Ss in this study were required to reach one errorless trial, and were given two over-learning trials so that predictions about performance after the last learning trial cannot be made at or near a probability of one. To obtain the best possible alternative measures for "level of learning," two types of scores were analyzed: (1) the ratio between the sum of correct anticipations and the total number of possible anticipations, i.e., the row labeled correct anticipation in Table 1; and (2) the number of correct responses on the two additional trials after the criterion trial.

Ratio of correct anticipations. There were significant group differences on List I, $F(5, 114) = 22.82$, $p < .01$, and to a lesser extent on List II, $F(5, 114) = 2.55$, $p < .05$. In addition the Random, $F(1, 114) = 42.38$, $p < .01$, Glosses-RBBR, $F(1, 114) = 28.50$, $p < .01$, and to a lesser extent Glosses-BRBR, $F(1, 114) = 6.13$, $p < .05$, had significantly higher ratios of correct anticipations on List II than List I.

Multiple group comparisons on List I indicate that the Indirect group had a significantly higher ratio than all the other groups, while the Random group

was significantly lower than all other groups. Furthermore, the Successive, the Alternate, and the Glosses-BRBR groups were significantly higher than Glosses-RBBR. On List II, the Random group had a lower ratio of correct responses than the Indirect, Glosses-BRBR and Glosses-RBBR groups.

On the whole, this analysis shows that on List I, the consecutive order groups obtained a higher ratio of correct anticipations than the concurrent order groups while on List II, only the Random group was significantly lower than the Indirect, Glosses-BRBR and Glosses-RBBR (the last two being concurrent order groups).

Number of correct responses on the two trials after the criterion trial. An analysis of the number of correct responses on the two post-criterion trials provides information on the strength of form-syllable associations. The results show significant group differences F (5, 114) = 7.94, $p < .01$. However, variations from List I to List II and the interaction between groups and lists were not significant, indicating that the obtained group differences were the same for both lists. The Random group made significantly more errors on these two trials than all other groups, and the Alternate group was significantly lower than the Indirect group. Thus, at the end of the learning period the associative strengths between forms and syllables were weakest for the Random group and strongest for the Indirect group.

These two sets of results suggest that Ss in the Random group, and to a lesser extent the Ss in the other concurrent order groups, had not mastered the associations between the forms and syllables as thoroughly as the consecutive order groups had. Thus, in the comparison of retention measures,

especially List I items, the concurrent order groups would be at a disadvantage as far as level of learning is concerned.

It has also been suggested by Underwood (1964) that Ss whose learning rate is slower than others for the list as a whole might have had certain items on the list which reached asymptote early in learning and these might then be overlearned as S endeavored in subsequent trials to learn the other items on the list. On retention tests, slow-learning Ss would correctly recall these very items that were overlearned. Consequently a further analysis of individual items was carried out and it was found that the number of sequentially correct anticipations subsequent to the last error was not correlated with the number of correct responses on the immediate recall tests.

The overall results clearly indicate that the Random group required more trials to reach criterion and did not achieve as high a level of learning, and, at the end of the learning period, had not mastered the association between the symbols and referents as well as the other groups. The Alternate group was slightly better than the Random, but did not improve on List II, and made some errors on the two trials after criterion. The Ss in the Glosses-RBBR group were relatively slow in learning List I, but they improved on List II and finally were not reliably different from the consecutive order groups. The Glosses-BRBR and Successive groups did not differ from the Indirect on trials to criterion, but they had a lower level of learning score than the Indirect group, especially on List I. Finally, the Indirect group required the least number of trials to criterion and had the highest level of learning score.

Group Comparisons on Immediate Retention Measures

In comparing the groups on retention, no attempt has been made to correct

for differences in level of learning. Rather than risk the possibility of inappropriately inflating the magnitude of retention in the concurrent order groups by a statistical correction, the groups are considered comparable in level of learning, although certain methods of vocabulary presentation, namely Random, Alternate and Glosses-RBBR, require more training than others. Table 2 presents the mean number of items recalled correctly on the three immediate retention tests.

Separated-Order Recall. The groups differed on the recall of List I items, $\underline{F}(5, 108) = 6.96$, $\underline{p} < .01$, but not for List II items. The Indirect group recalled significantly more List I items than all other groups; recall among the remaining groups was not significantly different. Furthermore, the Indirect group $\underline{F}(1, 108) = 16.59$, $\underline{p} < .01$ recalled more List I than List II items, whereas the Successive $\underline{F}(1, 108) = 22.32$, $\underline{p} < .01$, Glosses-BRBR $\underline{F}(1, 108) = 9.88$, $\underline{p} < .01$ and Alternate $\underline{F}(1, 108) = 6.71$, $\underline{p} < .05$, groups recalled more items from List II than List I. The Random and Glosses-RBBR groups recalled as many items learned on List I as on List II.

To summarize, significant differences attributable to training procedures were observed only on the recall of List I items where the Indirect group was significantly better than all the other groups. The results also indicate that the Successive, Glosses-BRBR and the Alternate groups remembered recently learned items (List II) much better than those learned earlier (List I), while the reverse was true for the Indirect group. Two concurrent order groups, Random and Glosses-RBBR, showed equal retention of items learned on List I and List II.

Table 2

Group Means for the Number of Correct Responses

on the Immediate Retention Tests (N=20)

Groups	Separated-Order		Mixed-Order		Vocabulary Identification	
	List I	List II	List I	List II	List I	List II
Random	2.10	2.55	2.25	2.80	2.95	3.50
Alternate	1.80	2.55	1.55	2.35	2.85	2.70
Glosses-RBBR	2.40	2.85	2.30	3.05	3.15	3.55
Glosses-BRBR	1.60	2.50	1.90	2.40	2.80	3.20
Successive	1.35	2.70	1.35	2.45	2.90	2.55
Indirect	3.30	2.05	2.65	1.50	2.90	2.70

Mixed-Order Recall. The results indicate significant overall group differences in recall $F(5, 108) = 2.81$, $p < .05$, due to different training procedures. Multiple group comparisons on List I items indicate that the Successive and Alternate groups recalled fewer items than the Indirect group. Group differences in the recall of List II items clearly indicate that the Indirect group recalled significantly fewer items than all other groups. The results also indicate that the Successive $F(1, 108) = 9.38$, $p < .01$, and to a lesser extent the Glosses-RBBR $F(1, 108) = 4.42$, $p < .05$, groups recall more items from List II than List I. The Ss in the Indirect group recall more items from List I than List II $F(1, 108) = 10.00$, $p < .01$, and the Random, Alternate and Glosses-BRBR groups recall as many items from List I as List II.

Thus, significant differences among the six training procedures were observed in the Mixed-Order recall test. The Ss in the Indirect group were better than the Alternate and Successive groups on List I, but these Ss were clearly inferior to all the other groups on List II.

Analysis of Correct Pairs of Glosses. This analysis indicates whether the two syllables (glosses) associated with one form were recalled differentially in each of the groups. The number of correct pairs of glosses is an index of the level at which contrasting items from the two vocabularies were equally available. Table 3 lists the group means for the number of correct pairs recalled in the Separated-Order and Mixed-Order tests. An analysis of variance for the Separated-Order test indicated that the groups did not differ in the number of correct pairs while they did for the Mixed-Order test, $F(5, 114) = 5.78$, $p < .01$, with the Glosses-RBBR group recalling significantly more pairs of

Table 3

Group Means for the Number of Correct Pairs of Glosses Recalled in the Separated-Order and Mixed-Order Tests

Groups	Separated-Order	Mixed-Order
Random	1.45	1.65
Alternate	1.40	1.05
Glosses-RBBR	2.00	2.20
Glosses-BRBR	1.30	1.55
Successive	1.00	0.70
Indirect	1.85	1.00

glosses than the Alternate, Indirect and Successive groups; and the Random and Glosses-BRBR more pairs than the Successive group. Thus, when the recall test did not require Ss to unexpectedly switch vocabularies, comparable numbers of contrasting items were available for all the groups. However, when the recall test required Ss to switch from one vocabulary to another, as in the Mixed-Order condition, the Successive, Indirect and Alternate groups recalled fewer pairs of glosses than the other groups, especially the Glosses-RBBR.

These results are consistent with the procedural differences characterizing each of the learning conditions in that the various groups tend to recall more pairs of glosses on the recall test that was procedurally more similar to their own learning condition. Only the Successive group had a complete separation between vocabularies during learning, and this group had the least number of correct pairs of glosses, apparently because the color cue which differentiated the contrasting items in the two vocabularies was not a necessary component of this group's learning condition. They could reach criterion even if they disregarded the color cue completely. Although Ss in the Indirect group were exposed to the glosses in List II (since the blue vocabulary syllables served as stimulus terms for the red vocabulary syllables), their training procedure did not encourage them to discriminate between form-syllable items of one vocabulary with their counterparts in the other. Thus these Ss could also reach criterion without paying attention to the color cue. Like the Successive group, the Indirect had more correct pairs of glosses in the Separated-Order test.

Of all the concurrent order groups, the Alternate recalled more correct pairs on the Separated than on the Mixed-Order test--a pattern characteristic of the consecutive order groups. But this is not inconsistent with the fact

that of all concurrent order groups, the Alternate had the largest temporal separation between vocabularies, and that Ss in this condition had to be alert to the color cue only at the points of alternation. The Glosses-BRBR condition provided Ss with systematic pairs of glosses, but they could eventually predict the vocabulary of the subsequent item. The Ss in the Random group had to be very alert to the color cue, but were not provided with systematic pairs of glosses. Thus, Ss who were provided with pairs of glosses in close temporal sequence and who had to be alert to the color cue--the essential features of the Glosses-RBBR condition--had the largest number of correct pairs of glosses on both recall tests.

Reversal errors in the Separated-and Mixed-Order Recall Tests. Reversal errors (e.g., YOP, when QAP was called for, Figure 1) reflect interference between vocabularies and indicate that the S had formed an association between a form and its syllable but could not respond appropriately to the cue which differentiated contrasting items. In all groups except the Indirect, more reversal errors occur on List I than on List II items. The reverse is true for the Indirect group. In general, the consecutive order groups made more reversal errors than the concurrent order groups, especially on the Mixed-Order recall test. The least number of reversal errors were observed in the concurrent order groups which were trained in sequence of glosses. The training procedures for the consecutive order groups were designed to eliminate the possibility of interference during learning, while the concurrent order groups had to overcome the interference problem before they could reach the criterion for learning. The results demonstrate that Ss were better able to differentiate between the two vocabularies during recall if their training procedures drew attention to the

contrasting items and afforded experience in the handling of interference.

Vocabulary Identification Test. There were no significant differences among groups, indicating that although the groups differed on immediate recall, their ability to identify the appropriate vocabulary of form-syllable pairs was comparable.

In summary, the analysis of the immediate tests of retention reveal significant differences among the six training conditions. Group differences were more pronounced on the Mixed- than the Separated-Order test because the Indirect, and to a lesser extent the Successive and Alternate groups, gave fewer correct responses on the Mixed-Order test, whereas the Random, Glosses-BRBR and Glosses-RBBR groups gave more, reflecting the effects of procedural similarity between the learning and testing conditions. Since the consecutive order groups learned each vocabulary separately, they had difficulty in switching from one vocabulary to another when required to do so on the Mixed-Order test. Even the Alternate procedure with a temporal separation of about 1.2 minutes between the two vocabularies did not afford sufficient experience in switching vocabularies.

On both tests, the Indirect group recalled more List I than List II items, apparently because List I syllables served as mediators during the acquisition of List II, allowing Ss to practice and strengthen List I responses while learning List II (Barnes and Underwood, 1959). On List II, however, the Indirect group had the lowest mean on both recall tests, most probably because they learned to associate one set of syllables with their counterparts in the other vocabulary rather than directly with their forms. This outcome is consonant with previous research (Kopstein and Roshal, 1954, and 1961; Wimer and

Lambert, 1959; and Carroll, 1963), which indicates that new vocabulary items are best learned when associations are made between the symbols to be learned and representational stimuli rather than through another set of symbols.

The other groups, especially the Successive, recalled more of the recently learned items of List II. Interference theorists (e.g., Postman, 1961) argue that during the acquisition of the second list in an A-B, A-C design, first list responses are extinguished or unlearned so that at the time of recall, second list responses will be more available. The results for the Successive group strongly support this prediction, whereas the outcome for the Indirect group poses an interesting problem.

The training conditions for the concurrent order groups essentially follow an A-B, C-D design with the additional feature that the stimulus terms in each list were to be associated with two different responses. If the predicted effects of generalized response competition (Postman, 1961) are considered, Ss would be expected to respond in terms of the more recently learned list--that is, the concurrent order group should recall more List II, than List I items. The results for the Alternate and Glosses-BRBR groups on the Separated-Order test are consonant with this view, as are those for the Glosses-RBBR on the Mixed-Order test. In all other instances, however, differences between the recall of List I and List II were not significant. Thus the expected effects of generalized response competition were not strongly evident for the concurrent order groups. The concurrent-order training procedures may have been of some aid in resisting generalized response competition because Ss had to be more alert during learning, making them less likely to forget the first list.

The Glosses-RBBR group ranked second to the Indirect group on the recall of List I items and was consistently better than all other groups on the recall of List II items. Furthermore, Ss in this group recalled more pairs of glosses than all the other groups.

The groups did not differ on the Vocabulary Identification test, indicating that all Ss were equally able to identify the two vocabularies immediately after the learning period. Barnes and Underwood (1959), in a related study, found differences in recall to be a function of amount of training on an interpolated list, but all their groups identified list membership with a high degree of accuracy. Apparently the demands of an identification test are less stringent than those of a recall test. For example, in the consecutive order groups, if Ss knew one list well they could then distinguish one vocabulary from the other.

Group Comparisons on Delayed Retention Measures

A similar series of analyses were carried out for each group's retention after a two to three week delay when they had no reason to anticipate a re-test of any sort. The results can be summarized as follows. (1) The analysis of correct responses on the Separated-and Mixed-Order retention tests clearly show the superiority of the Glosses-RBBR group over all other groups. The Random and Indirect groups had similar means and were somewhat better than the Alternate, Glosses-BRBR and Successive groups, while the Alternate group had the poorest retention. On both tests, the results indicate that Ss in all groups retained more List I than List II items. (2) The Ss in the Glosses-RBBR group also retained more pairs of glosses than all the other groups. (3) The results for the vocabulary identification test indicate that the Glosses-RBBR group had more correct responses than all other groups, especially on

List II items. In general, more correct responses were observed on List I than List II items, significantly so for the Glosses-BRBR group. Reversal errors occurred most in the Indirect group and least in the Glosses-RBBR group.

In general, the results of delayed retention measures indicate more pronounced group differences than were observed in the immediate retention tests. Significant differences were obtained on all the delayed tests, while on the immediate tests, group differences were observed only for the Mixed-Order test and with List I items in the Separated-Order test. On all delayed measures, Ss trained according to the Glosses-RBBR procedure showed significantly better retention than the other groups.

A rough estimate of the amount of forgetting that took place for each of the groups is provided by the differences between mean correct responses on the immediate and delayed tests, Table 4. The mean differences for List I items indicate slight gains for the Random, Glosses-RBBR, Successive and Glosses-BRBR groups, and a loss for the Alternate and Indirect groups. All groups show forgetting for List II items.

The slight gains observed on List I items and the loss on List II items resulted in higher mean correct responses for List I than List II on the delayed tests. It will be recalled that on immediate tests the Successive group recalled more List II than List I items. One suggested interpretation is that in an A-B, A-C design, first list responses are unlearned or extinguished during the acquisition of the second list, but in time these responses become available in a fashion analogous to spontaneous recovery (Postman, 1961). The Successive procedure was most likely to induce unlearning or extinction and it is this group that shows some gain for List I items in both the Separated-

Table 4

Group Mean Differences in Correct Responses

between Immediate and Delayed Tests

Groups	Separated-Order		Mixed-Order		Vocabulary Identification	
	List I	List II	List I	List II	List I	List II
Random	0.35	-0.70	0.20	-1.45	0.10	-0.60
Alternate	-0.48	-1.39	0.03	-1.03	-0.22	-0.28
Glosses-RBBR	0.53	-0.25	0.70	-0.45	0.12	-0.02
Glosses-BRBR	0.20	-1.00	0	-1.25	0.65	-1.15
Successive	0.65	-1.29	0.24	-1.10	-0.61	-0.26
Indirect	-1.35	-0.35	-0.60	0.25	-0.35	-0.15

Note: Negative values indicate a loss in delayed retention. Group means for delayed retention can be reconstructed by adding corresponding values from Table 2.

Order and Mixed-Order tests. The Indirect group, on the other hand, lost more from List I than List II. The Ss in this group would not be expected to show delayed gains on List I because their learning condition was conducive to the strengthening of List I responses during the acquisition of List II. Thus they would be expected to show forgetting on both lists, but it is not clear why more forgetting actually occurred on List I than List II.

A possible interpretation of the concurrent order results is inherent in Jost's law which states that "if two associations are now of equal strength but of different ages, the older one will lose strength more slowly with further passage of time" (Woodworth and Schlosberg, 1955, p. 730). For the concurrent groups, differences between List I and List II items were not pronounced on the immediate recall tests, indicating that these groups, especially the Random, tended to recall as many items learned on List I as List II. With time the newer associations would be expected to lose more strength than the older, and the results generally support this expectation. In general, if we consider the amount of delayed retention in the Separated-Order and Mixed-Order tests, the results clearly indicate that Glosses-RBBR retained significantly more items than all other groups. The Alternate group showed the most forgetting and the Random and Indirect groups performed better than the Successive and Glosses-BRBR groups.

Group differences in the Vocabulary Identification test suggest that Glosses-RBBR and to some extent the Random Ss were better than the other groups in Vocabulary Identification, that is, those Ss who had to be particularly alert to the color cue during acquisition were less likely to forget the vocabulary of a given form-syllable combination.

Conclusions

The present study evaluated various modes of presenting two contrasting vocabularies, as might be done in bilingual settings, in terms of rate of learning and amount of immediate and delayed retention.

The results indicate that fewer trials were required to reach criterion when Ss were presented with each vocabulary separately, as in the consecutive order groups, than when contrasting items were presented in close temporal order, as in the concurrent order groups. Furthermore, the speed of learning in the concurrent order groups was positively related to how predictable the vocabulary of subsequent items on a list was. However, when the speed of learning and quality of retention on immediate and delayed tests are considered, the Glosses-RBBR procedure is the most effective of all six. Ss in this group encountered interference between contrasting items during acquisition, especially on List I, but the number of trials to criterion and reversal errors were greatly reduced on List II because, we believe, by then they were better able to make use of the organization of the sequences of glosses. Unlike the Ss in the Glosses-BRBR and Alternate conditions, they had to be alert to the color cue, since they could not predict the vocabulary of subsequent items during learning. By having to cope with contrasting vocabulary items while learning, these Ss were forced to respond to the cue (color) which signaled each of the two symbols to be associated with one referent. In Gibson's (1963) terms, Ss in the concurrent order groups were made to respond to those features of stimulation which were critical for rendering each referent unique. Learning to discriminate the critical features of two contrasting vocabularies would be more effective if Ss could

compare contrasting items sequentially. The Glosses-RBBR and Glosses-BRBR groups had fewer reversal errors than any other group apparently because they could always compare the contrasting items sequentially. The Random group was better than the consecutive order groups or the Alternate group since in this procedure Ss could occasionally compare contrasting items sequentially; the Alternate group had very few occasions to make such comparisons, and they had almost as many reversals as the consecutive order groups whose Ss had no such occasions. A related study by Gagne' (1950) also emphasizes the importance of providing Ss with opportunity to differentiate between highly similar stimuli in paired-associate lists. He compared a procedure that placed similar stimuli in adjacent positions with another that distributed them through a list. In the early phases of learning, the contiguous condition produced more confusion errors, but gradually better differentiation was shown until finally superior performance was observed.

This suggests that interference during learning is not necessarily detrimental if opportunities for overcoming the interference are made part of the learning procedure. In this case, Ss were able to overcome interference by learning to discriminate between contrasting items, especially if they could compare them sequentially. The advantage of this condition is that Ss could transfer the learned discrimination to other new items (Gibson, 1963). This was not possible for the Alternate Ss who showed no improvement on List II. In contrast, mere exposure to contrasting items with no provisions for discrimination, as in the case of the Indirect group on List II, produced errors of interference on retention tests (the Indirect group had more reversal errors than any other group).

Finally, provisions for close comparison between contrasting items with the procedural requirement of being alert to the color cue produces an important difference in retention. The color cue was less important for the Glosses-BRBR group because of the regular sequencing of the items and this group had consistently fewer correct responses than the Glosses-RBBR group.

Although the learning conditions investigated are analogues only of various methods of learning vocabularies, the results demonstrate the advantages of incorporating discrimination learning and alertness to critical cues when contrastive material is being taught. Whether the facilitative features of the Glosses-RBBR condition are limited to vocabulary learning can be determined only by further research of a similar nature with other aspects of language instruction.

FOOTNOTES

1. The study reported here was presented as Part II of a Ph. D. dissertation (Yeni-Komshian, 1965) submitted to the Graduate Faculty of McGill University, Montreal, Canada. The research supported by grants from the Defence Research Board of Canada and the Carnegie Corporation of New York. The authors are indebted to the principal and students of Outremont High School for their cooperation, and to Malcolm S. Preston and Sandra Pyke for their suggestions and criticisms. We are also grateful to Sandra Witelson for her help in the preliminary phases of this work.

2. The data are analyzed according to different analysis of variance models. In all cases differences due to the training procedures given the six groups are referred to as groups; and differences between List I versus List II items are referred to as lists. Significant interactions are interpreted by tests on the simple effects of one factor at different levels of the second factor. Tests on simple effects are analogous to a series of one-way analyses of variance on different levels of another variable. This procedure locates the factor level combinations which contribute to the significant interaction (Winer, 1962, p. 174). The Newman-Keuls test (Winer, 1962, p. 80) is used for multiple group comparisons; however, the level of significance ($p < .05$ or less) will not be reported in the text. Detailed descriptions of results are found in Yeni-Komshian, 1965.

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